

SUPPLEMENTAL MATERIAL

Persistent Organic Pollutants in Norwegian Men from 1979 to 2007: Intraindividual Changes, Age–Period–Cohort Effects, and Model Predictions

Therese Haugdahl Nøst,^{1,2,3} Knut Breivik,^{4,5} Ole-Martin Fuskevåg,³ Evert Nieboer,^{1,6} Jon Øyvind Odland,¹ and Torkjel Manning Sandanger^{1,2}

¹Department of Community Medicine, University of Tromsø, Tromsø, Norway; ²NILU-Norwegian Institute for Air Research, Fram Centre, Tromsø, Norway; ³University Hospital of North Norway, Tromsø, Norway; ⁴NILU-Norwegian Institute for Air Research, Kjeller, Norway;

⁵Department of Chemistry, University of Oslo, Oslo, Norway; ⁶Department of Biochemistry and Biomedical Sciences, McMaster University, Hamilton, Ontario, Canada.

Table of contents

Supplemental Material, Table S1	Page 2
Information on dietary parameters used in CoZMoMAN modeling	Page 3
Supplemental Material, Table S2	Page 4
Supplemental Material, Table S3	Page 5
Supplemental Material, Table S4	Page 6
Supplemental Material, Figure S1	Page 8
Supplemental Material, Figure S2	Page 9
Supplemental Material, Figure S3	Page 10
Supplemental Material, References	Page 11

Supplemental Material, Table S1: List of compounds analyzed in blood samples.

Analyzed compounds	Abbreviation or IUPAC No.
Polychlorinated biphenyls (PCBs)	Congeners 18, 28/31, 33, 47/49, 52, 99, 101, 105, 118, 123, 128, 138/163, 141, 149, 153, 156, 157, 167, 170, 180, 183, 187, 189, 194
Hexachlorocyclohexanes (HCHs)	α -HCH, β -HCH, γ -HCH
Hexachlorobenzene	HCB
Chlordanes (CHLs)	<i>trans</i> - and <i>cis</i> -Chlordane, <i>oxy</i> -Chlordane, <i>trans</i> - and <i>cis</i> -Nonachlor
Mirex	
DDT and metabolites (DDTs)	1,1,1-trichloro-2,2-bis(<i>p</i> -chlorophenyl)ethane (<i>p,p'</i> -DDT) 1,1,1-trichloro-2-(<i>o</i> -chlorophenyl)-2-(<i>p</i> -chlorophenyl)ethane (<i>o,p'</i> -DDT) 1,1-dichloro-2,2-bis(<i>p</i> -chlorophenyl)ethene (<i>p,p'</i> -DDE) 1,1-dichloro-2-(<i>o</i> -chlorophenyl)-2-(<i>p</i> -chlorophenyl)ethene (<i>o,p'</i> -DDE) 1,1-dichloro-2,2-bis(<i>p</i> -chlorophenyl)ethane (<i>p,p'</i> -DDD) 1,1-dichloro-2-(<i>o</i> -chlorophenyl)-2-(<i>p</i> -chlorophenyl)ethane (<i>o,p'</i> -DDD)
Toxaphenes	Parlar 26 (B8–1413) and 50 (B9–1679)

Supplemental Material, Information on dietary input parameters used in CoZMoMAN.

The original description of dietary habits is based on the food consumption of the Swedish population (Czub and McLachlan 2004). Specifically, scenarios for the ingestion of fish, beef and dairy products were developed as a function of time from 1930 onwards. However, dietary habits of the current study population (i.e., men in Northern Norway) are likely to differ from the Swedish population with respect to fish consumption in particular. While historical dietary information from study subjects were insufficient, information on fish consumption in the Norwegian population is only available for the years after 1995 (Norwegian Directorate of Health 2010). While the general Swedish population eats fish 1.7 times/week, the general Norwegian population does so 2.3 times/week (Bergsten 2004). Most detailed information on fish consumption in the Norwegian population was available for 2000, and the dietary input to CoZMoMAN reflected this information by adjusting the original time-variant dietary parameterization to the numeric information for year 2000 (see Table S2: average fish consumption scenario for Norway (FC_{avr})).

An even higher rate of fish consumption was expected for the study population, compared to the general Norwegian population. High age, male sex and living in Northern Norway are all factors associated with high fish consumption (Alexander et al. 2006; Bergsten 2004; Johansson and Solvoll 1999). Simulations were therefore carried out based on four different scenarios for fish intake, representing the average Norwegian fish intake (as detailed above), as well as for three additional scenarios representing increased consumption of fish (FC1-FC3, see Table S2).

The highest fish consumption category (FC3) data were obtained by adjusting the fish consumption to a 95% percentile of total daily fish intake in 2000 (Bergsten 2004) (see Table S2), with a corresponding reduction in the intake of meat. Two additional categories between the average Norwegian fish intake and the highest were calculated (see Table S2). Furthermore, the proportion of fish intake comprised of lean fish is high in the Norwegian population (2/3 of all fish consumption) (Alexander et al. 2006) and the herring/cod ratio used as a fat fish/lean fish indication in the model was consequently changed from 0.75/0.25 in the Swedish dietary parameters to 0.35/0.65 for the study population. Meat consumption was adjusted corresponding to changes in fish consumption in all categories. Consumption of dairy products in the study population as a function of time was assumed to be similar to that of the Swedish population.

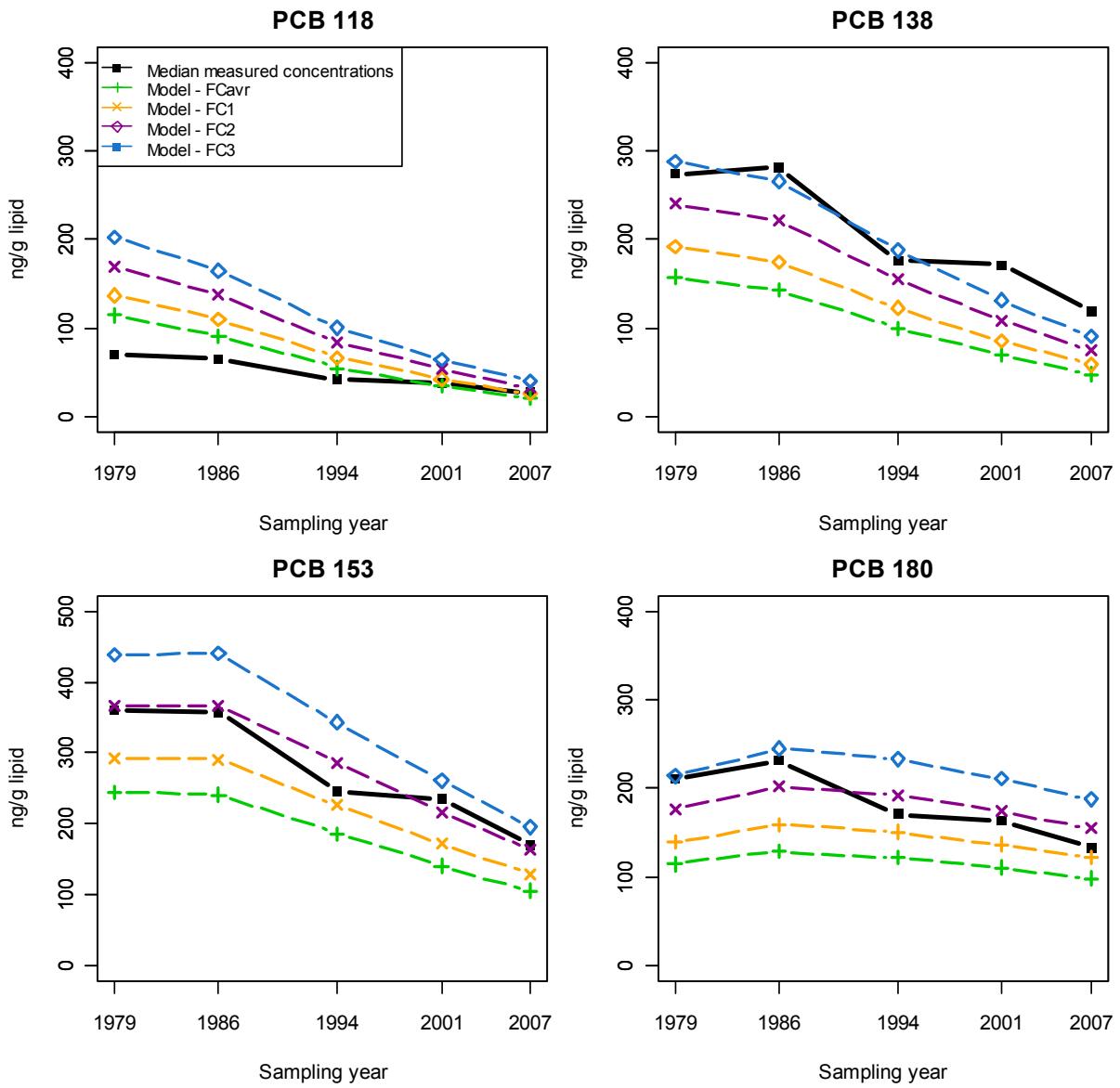
In model simulations presented in Figure 4 and Supplemental Material, Figure S3, the fish consumption categories for the birth cohorts 1930, 1935, 1940 and 1945 were assumed to be F3, F2, F1 and F_{avr} , respectively.

Supplemental Material, Table S2: Fish consumption categories used in CoZMoMAN.

Fish consumption category	Abbreviation	Original CoZMoMAN parameterization (g ww/day in 2000)	In this article (g ww/day in 2000)
Average	FC_{avr}	92	124
Higher 1	FC1		156
Higher 2	FC2		202
Higher 3	FC3		248

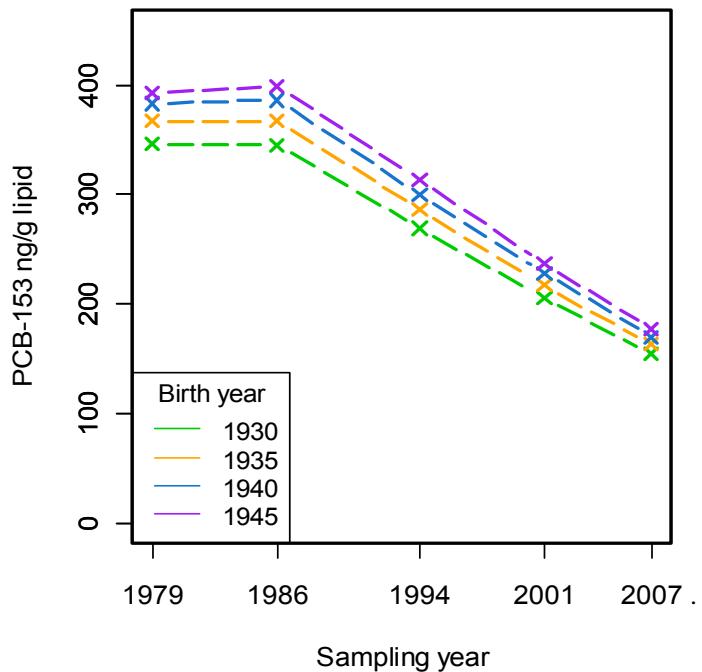
Supplemental Material, Table S3: Number of subjects in each quartile of the variables age and birth year.

Sampling year	Age quartiles				Birth year quartiles			
	29-47	47-57	57-66	66-82	1925- 1934	1934- 1936	1936- 1941	1941- 1950
1979	42	9	0	0	14	12	14	11
1986	17	29	5	0	15	12	14	10
1994	5	18	19	3	12	10	13	10
2001	0	7	29	12	12	13	13	10
2007	0	1	13	38	15	13	13	11

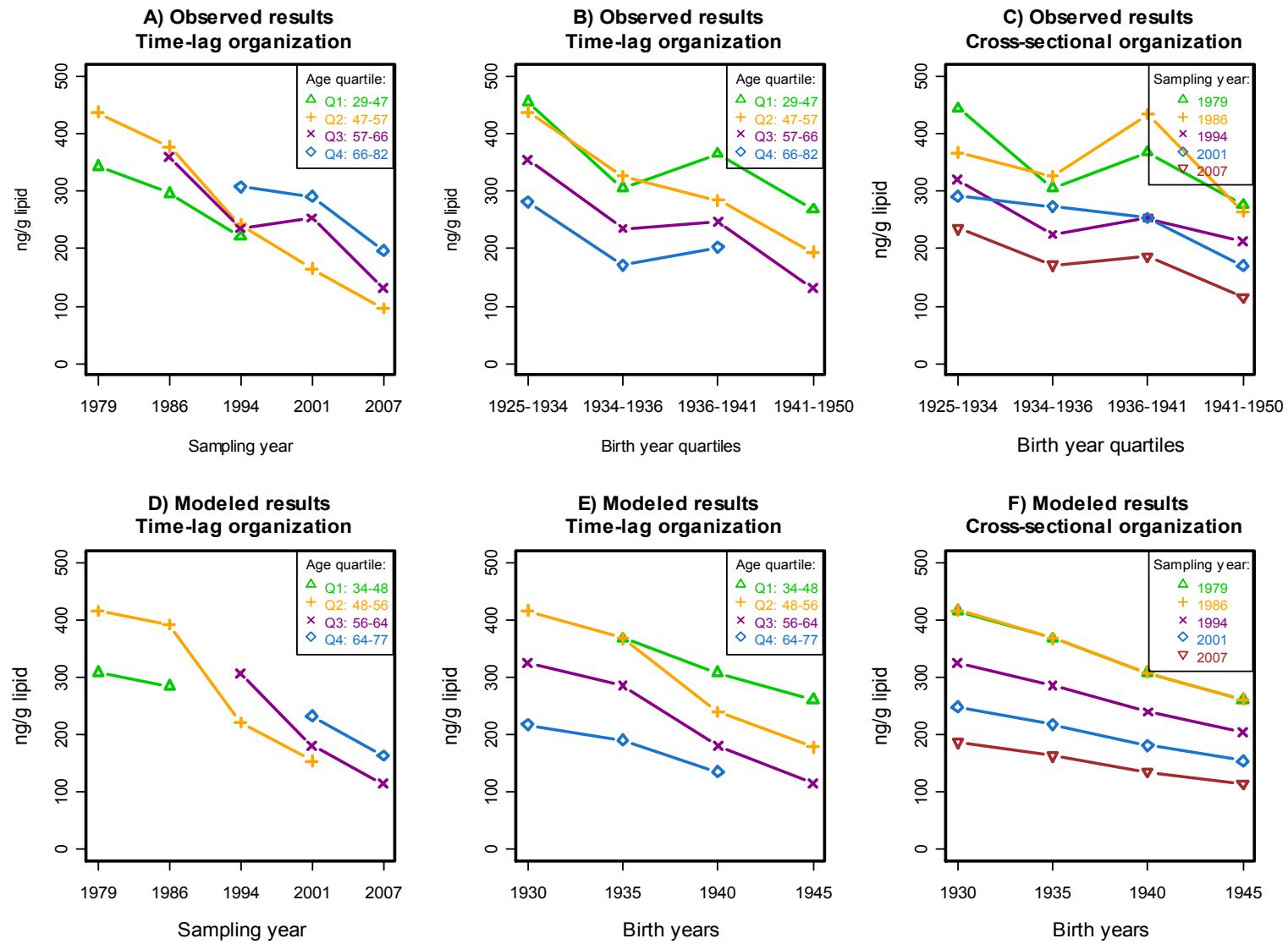


Supplemental Material, Figure S1: Model predictions of concentrations (ng/g lipid) of PCBs 118, 138, 153, and 180 in a male 1935 birth cohort shown along with median measured concentrations in 1979, 1986, 1994, 2001 and 2007. Separate predictions for average Norwegian fish consumption (FC_{avr}) and three categories of higher fish intake rates are presented (FC1-FC3).

Model predictions
Equal fish consumption in birth cohorts &



Supplemental Material, Figure S2: Model predictions of concentrations (ng/g lipid) of PCB-153 are displayed for the 1930, 1935, 1940 and 1945 male birth cohorts. All cohorts are assumed to have equal fish consumption (FC2).



Supplemental Material, Figure S3: Remaining plots of graphical APC examination in PCB-153 concentrations. This figure complements Figure 4 in the main text. A and D depict time-lag variation among age groups according to sampling period, B and E time-lag variation among age groups according to birth cohort group, and C and F cross-sectional variation among sampling periods according to birth cohort group.

Supplemental Material, References

- Alexander J, Frøyland L, Hemre G, Koster Jacobsen B, Lund E, Meltzer H. 2006. Et helhetssyn på fisk og annen sjømat i norsk kosthold. [in Norwegian] Oslo, Norway. Norwegian Scientific Committee for Food Safety. Available from: www.vkm.no/dav/a2805d6a8c.pdf
- Bergsten C. 2004. Fish and game study, part B. (The consumption of foods that may be important when assessing the dietary intake of mercury, cadmium and PCB/dioxins, with a focus on population groups living on the coast and in the inland of Norway). [in Norwegian] Oslo, Norway. Norwegian Food Safety Authority. Available from: www.mattilsynet.no/mattilsynet/multimedia/archive/00016/Fisk_og_vilt__Fish_a_16664a.pdf
- Czub G, McLachlan MS. 2004. A food chain model to predict the levels of lipophilic organic contaminants in humans. Environ Toxicol Chem 23(10): 2356-2366.
- Johansson L, Solvoll KN. 1999. Norkost 1997. Landsomfattende kostholdsundersøkelse blant menn og kvinner i alderen 16-79 år. [in Norwegian] Report No.: 2/1999. Oslo, Norway. National Council on Nutrition and Physical Activity. Available from: www.helsedirektoratet.no/folkehelse/ernering/tall-og-undersokelser/Documents/norkost-1997.pdf
- Norwegian Directorate of Health. 2010. Utviklingen i norsk kosthold. Matforsyningssstatistikk og Forbruksundersøkelser. [in Norwegian] Report No.: IS-1873. Oslo, Norway. Available from: <http://www.helsedirektoratet.no/publikasjoner/utviklingen-i-norsk-kosthold-2010-stor-utgave/Publikasjoner/utviklingen-i-norsk-kosthold2010-stor-utgave.pdf>